

Title 15 - Mississippi Department of Health

Part III – Office of Health Protection

Subpart 78 – Division of Radiological Health

CHAPTER 01 REGULATIONS FOR CONTROL OF RADIATION IN MISSISSIPPI

500 Radiation Safety Requirements For Industrial Radiographic Operations

500.01 Purpose. This section prescribes requirements for the issuance of licenses or registrations for the industrial use of sources of radiation and radiation safety requirements for persons using these sources of radiation in industrial radiography.

500.02 Scope. The provisions and requirements of this section are in addition to, and not in substitution for, other applicable requirements of these regulations. Except for those regulations of this section clearly applicable only to sealed radioactive sources, both radiation machines and sealed radioactive sources are covered by this section.

500.03 Definitions. As used in this section, the following definitions apply:

"Annual refresher safety training" means a review conducted or provided by the licensee or registrant for its employees on radiation safety aspects of industrial radiography. The review shall include, as a minimum, any results of internal inspections, new procedures or equipment, new or revised regulations, and accidents or errors that have been observed. The review shall also provide opportunities for employees to ask safety questions.

"ANSI" means the American National Standards Institute.

"Associated equipment" means equipment that is used in conjunction with a radiographic exposure device to make radiographic exposures that drives, guides, or comes in contact with the source.¹

"Cabinet radiography" means industrial radiography conducted in an enclosure or cabinet so shielded that radiation levels at every location on the exterior meet the dose limits for individual members of the public as specified in 400.14 of these regulations.

"Cabinet x-ray system" means an x-ray system with the x-ray tube installed in an enclosure independent of existing architectural structures except the floor

¹ e.g., guide tube, control tube, control (drive) cable, removable source stop, "J" tube and collimator when used as an exposure head.

on which it may be placed. The cabinet x-ray system is intended to contain at least that portion of a material being irradiated, provide radiation attenuation, and exclude personnel from its interior during generation of radiation. Included are all x-ray systems designed primarily for the inspection of carry-on baggage at airline, railroad, and bus terminals, and in similar facilities. An x-ray tube used within a shielded part of a building, or x-ray equipment which may temporarily or occasionally incorporate portable shielding, is not considered a cabinet x-ray system.

"Camera" see "Radiographic exposure device".

"Certifiable cabinet x-ray system" means an existing uncertified x-ray system that has been modified to meet the certification requirements specified in 21 CFR 1020.40.

"Certified cabinet x-ray system" means an x-ray system which has been certified in accordance with 21 CFR 1010.2 as being manufactured and assembled pursuant to the provisions of 21 CFR 1020.40.

"Certifying entity" means an independent certifying organization meeting the requirements in Appendix A of this section or a state regulatory program meeting the requirements in Appendix A, Sections II and III of this section.

"Collimator" means a radiation shield that is placed on the end of the guide tube or directly onto a radiographic exposure device to restrict the size of the radiation beam when the sealed source is cranked into position to make a radiographic exposure.

"Control cable" means the cable that is connected to the source assembly and used to drive the source to and from the exposure location.

"Control drive mechanism" means a device that enables the source assembly to be moved into and out of the exposure device.

"Control tube" means a protective sheath for guiding the control cable. The control tube connects the control drive mechanism to the radiographic exposure device.

"Drive cable" see "Control cable".

"Exposure head" means a device that locates the gamma radiography sealed source in the selected working position.²

"Field station" means a facility from which sources of radiation may be stored or used and from which equipment is dispatched.

² An exposure head is also known as a source stop.

"Guide tube" means a flexible or rigid tube, or "J" tube, for guiding the source assembly and the attached control cable from the exposure device to the exposure head. The guide tube may also include the connections necessary for attachment to the exposure device and to the exposure head.

"Hands-on experience" means experience in all of those areas considered to be directly involved in the radiography process.

"Independent certifying organization" means an independent organization that meets all of the criteria of Appendix A of this section.

"Industrial radiography" means an examination of the structure of materials by nondestructive methods utilizing ionizing radiation to make radiographic images.

"Lay-barge radiography" means industrial radiography performed on any water vessel used for laying pipe.

"Offshore platform radiography" means industrial radiography conducted from a platform over a body of water.

"Permanent radiographic installation" means an enclosed shielded room, cell, or vault, not located at a temporary jobsite, in which radiography is performed.

"Pigtail" see "Source assembly".

"Pill" see "Sealed source".

"Practical examination" means a demonstration through application of the safety rules and principles in industrial radiography including use of all procedures and equipment to be used by radiographic personnel.

"Projection sheath" see "Guide tube".

"Projector" see "Radiographic exposure device".

"Radiation safety officer for industrial radiography" means an individual with the responsibility for the overall radiation safety program on behalf of the licensee or registrant and who meets the requirements of 500.16.

"Radiographer" means any individual who performs or who, in attendance at the site where the sources of radiation are being used, personally supervises industrial radiographic operations and who is responsible to the licensee or registrant for assuring compliance with the requirements of these regulations and the conditions of the license or registration.

"Radiographer certification" means written approval received from a certifying entity stating that an individual has satisfactorily met the radiation safety, testing, and experience criteria in 500.17.

"Radiographer's assistant" means any individual who, under the direct supervision of a radiographer, uses radiographic exposure devices, sources of radiation, related handling tools, or radiation survey instruments in industrial radiography.

"Radiographic exposure device" means any instrument containing a sealed source fastened or contained therein, in which the sealed source or shielding thereof may be moved, or otherwise changed, from a shielded to unshielded position for purposes of making a radiographic exposure.

"Radiographic operations" means all activities performed with a radiographic exposure device, or with a radiation machine. Activities include using, transporting except by common or contract carriers, or storing at a temporary job site, performing surveys to confirm the adequacy of boundaries, setting up equipment, and any activity inside restricted area boundaries. Transporting a radiation machine is not considered a radiographic operation.

"Radiography" see "Industrial radiography."

"S-tube" means a tube through which the radioactive source travels when inside a radiographic exposure device.

"Sealed source" means any radioactive material that is encased in a capsule designed to prevent leakage or escape of the radioactive material.

"Shielded position" means the location within the radiographic exposure device, source changer, or storage container where the sealed source is secured and restricted from movement.

"Source assembly" means an assembly that consists of the sealed source and a connector that attaches the source to the control cable. The source assembly may include a ballstop to secure the source in the shielded position.

"Source changer" means a device designed and used for replacement of sealed sources in radiographic exposure devices, including those source changers also used for transporting and storage of sealed sources.

"Storage area" means any location, facility, or vehicle which is used to store, or to secure a radiographic exposure device, a radiation machine, a storage container, or a sealed source when it is not in use and which is locked or has a physical barrier to prevent accidental exposure, tampering with, or unauthorized removal of the device, container, or source.

"Storage container" means a container in which sealed sources are secured and stored.

"Temporary jobsite" means a location where radiographic operations are performed and where sources of radiation may be stored other than the location(s) of use authorized on the license or registration.

"Underwater radiography" means industrial radiography performed when the radiographic exposure device or radiation machine and/or related equipment are beneath the surface of the water.

500.04 Exemptions.

1. Uses of certified and certifiable cabinet x-ray systems are exempt from the requirements of this section except for the following:
 - a. For certified and certifiable cabinet x-ray systems, including those designed to allow admittance of individuals:
 - i. No registrant shall permit any individual to operate a cabinet x-ray system until the individual has received a copy of and instruction in the operating procedures for the unit. Records that demonstrate compliance with this subparagraph shall be maintained for Agency inspection until disposal is authorized by the Agency.
 - ii. Tests for proper operation of interlocks must be conducted and recorded at intervals not to exceed six months. Records of these tests shall be maintained for Agency inspection until disposal is authorized by the Agency.
 - iii. The registrant shall perform an evaluation of the radiation dose limits to determine compliance with 400.14(1), (2), and (3) of these regulations, and 21 CFR 1020.40, Cabinet X-Ray Systems (39 Federal Register 12986, April 10, 1974), at intervals not to exceed one year. Records of these evaluations shall be maintained for Agency inspection for two years after the evaluation.
 - b. Certified cabinet x-ray systems shall be maintained in compliance with 21 CFR 1020.40, Cabinet X-Ray Systems (39 Federal Register 12986, April 10, 1974), and no modification shall be made to the system unless prior Agency approval has been granted.
2. Industrial uses of hand-held light intensified imaging devices are exempt from the requirements of this section if the dose rate 18 inches from the source of radiation to any individual does not exceed 2 millirem per hour. Devices which exceed this limit shall meet the applicable requirements of this section and the licensing or registration requirements of Section 200 or Section 300 of these regulations, as applicable.

500.05 Licensing and Registration Requirements for Industrial Radiography Operations.

The Agency will approve an application for a specific license for the use of licensed material or a registration for use of radiation machines if the applicant meets the following requirements:

1. The applicant satisfies the general requirements specified in Section 200 for radiation machine facilities or Section 300 for radioactive material, as applicable, and any special requirements contained in this section;
2. The applicant submits an adequate program for training radiographers and radiographer's assistants that meets the requirements of 500.17:
 - a. After 2 years after the effective date of these regulations, the applicant need not describe the initial training and examination program for radiographers in the subjects outlined in 500.17.(7).
 - b. From August 11, 2001 to 2 years after the effective date of the regulations is published, the applicant may affirm that all individuals acting as industrial radiographers will be certified in radiation safety by a certifying entity before commencing duty as radiographers. This affirmation substitutes for a description of its initial training and examination program for radiographers in the subjects outlined in 500.17(7).
 - c. The applicant submits procedures for verifying and documenting the certification status of radiographers and for ensuring that the certification of individuals acting as radiographers remains valid;
 - d. The applicant submits written operating and emergency procedures as described in 500.18;
 - e. The applicant submits a description of a program for inspections of the job performance of each radiographer and radiographer's assistant at intervals not to exceed 6 months as described in 500.17(5);
 - f. The applicant submits a description of the applicant's overall organizational structure as it applies to the radiation safety responsibilities in industrial radiography, including specified delegation of authority and responsibility;
 - g. The applicant submits the qualifications of the individual(s) designated as the radiation safety officer as described in 500.16(1);
 - h. If an applicant intends to perform leak testing of sealed sources or exposure devices containing depleted uranium (DU) shielding, the applicant must describe the procedures for performing the test. The description must include the:

- i. Methods of collecting the samples;
 - ii. Qualifications of the individual who analyzes the samples;
 - iii. Instruments to be used; and
 - iv. Methods of analyzing the samples.
- i. If the applicant intends to perform calibrations of survey instruments and alarming ratemeters, the applicant must describe methods to be used and the experience of the person(s) who will perform the calibrations. All calibrations must be performed according to the procedures described and at the intervals prescribed in 500.09 and 500.20(7)(d);
 - j. The applicant identifies and describes the location(s) of all field stations and permanent radiographic installations;
 - k. The applicant identifies the location(s) where all records required by this and other sections of these regulations will be maintained;
 - l. If a license application includes underwater radiography, a description of:
 - i. Radiation safety procedures and radiographer responsibilities unique to the performance of underwater radiography;
 - ii. Radiographic equipment and radiation safety equipment unique to underwater radiography; and
 - iii. Methods for gas-tight encapsulation of equipment; and
 - m. If an application includes offshore platform and/or lay-barge radiography, a description of:
 - i. Transport procedures for radioactive material to be used in industrial radiographic operations;
 - ii. Storage facilities for radioactive material; and
 - iii. Methods for restricting access to radiation areas.
 - n. A license or registration will be issued if 500.05(1) through 500.05(13), as applicable, are met.

500.06 Performance Requirements for Industrial Radiography Equipment. Equipment used in industrial radiographic operations must meet the following minimum criteria:

1. Each radiographic exposure device, source assembly or sealed source, and all associated equipment must meet the requirements specified in American National Standard Institute, N432-1980 "Radiological Safety for the Design and Construction of Apparatus for Gamma Radiography,"(published as NBS Handbook 136, issued January 1981);
2. In addition to the requirements specified in 500.06(1), the following requirements apply to radiographic exposure devices, source changers, source assemblies or sealed sources.
 - a. The licensee shall ensure that each radiographic exposure device has attached to it a durable, legible, clearly visible label bearing the:
 - i. Chemical symbol and mass number of the radionuclide in the device;
 - ii. Activity and the date on which this activity was last measured;
 - iii. Model number or product code and serial number of the sealed source;
 - iv. Name of the manufacturer of the sealed source; and
 - v. Licensee's name, address, and telephone number.
 - b. Radiographic exposure devices intended for use as Type B packages must meet the applicable transportation requirements of Section 1300 of these regulations.
 - c. Modification of any exposure devices, source changers, and source assemblies and associated equipment is prohibited, unless approved by the Agency or other approval body.
3. In addition to the requirements specified in 500.06(1) and (2), the following requirements apply to radiographic exposure devices, source assemblies, and associated equipment that allow the source to be moved out of the device for radiographic operations or to source changers;
 - a. The coupling between the source assembly and the control cable must be designed in such a manner that the source assembly will not become disconnected if cranked outside the guide tube. The coupling must be such that it cannot be unintentionally disconnected under normal and reasonably foreseeable abnormal conditions.
 - b. The device must automatically secure the source assembly when it is cranked back into the fully shielded position within the device. This securing system may only be released by means of a deliberate operation on the exposure device.

- c. The outlet fittings, lock box, and drive cable fittings on each radiographic exposure device must be equipped with safety plugs or covers which must be installed during storage and transportation to protect the source assembly from water, mud, sand or other foreign matter.
 - d. Each sealed source or source assembly must have attached to it or engraved on it, a durable, legible, visible label with the words: "DANGER - RADIOACTIVE." The label must not interfere with the safe operation of the exposure device or associated equipment.
 - e. The guide tube must be able to withstand a crushing test that closely approximates the crushing forces that are likely to be encountered during use, and be able to withstand a kinking resistance test that closely approximates the kinking forces that are likely to be encountered during use.
 - f. Guide tubes must be used when moving the source out of the device.
 - g. An exposure head or similar device designed to prevent the source assembly from passing out of the end of the guide tube must be attached to the outermost end of the guide tube during radiographic operations.
 - h. The guide tube exposure head connection must be able to withstand the tensile test for control units specified in ANSI N432-1980.
 - i. Source changers must provide a system for ensuring that the source will not be accidentally withdrawn from the changer when connecting or disconnecting the drive cable to or from a source assembly.
- 4. All radiographic exposure devices and associated equipment in use after January 10, 1996, must comply with the requirements of this section; and
 - 5. As an exception to 500.06(1), equipment used in industrial radiographic operations need not comply with § 8.9.2(c) of the Endurance Test in American National Standards Institute N432-1980, if the prototype equipment has been tested using a torque value representative of the torque that an individual using the radiography equipment can reasonably exert on the lever or crankshaft of the drive mechanism.

500.07 Limits on External Radiation Levels from Storage Containers and Source Changers. The maximum exposure rate limits for storage containers and source changers are 2 millisieverts (200 mrem) per hour at any exterior surface, and 0.1 millisieverts (10 mrem) per hour at 1 meter from any exterior surface with the sealed source in the shielded position.

500.08 Locking of Sources of Radiation, Storage Containers and Source Changers.

1. Each radiographic exposure device must have a lock or outer locked container designed to prevent unauthorized or accidental removal of the sealed source from its shielded position. The exposure device and/or its container must be kept locked³ when not under the direct surveillance of a radiographer or a radiographer's assistant except at permanent radiographic installations as stated in 500.22. In addition, during radiographic operations the sealed source assembly must be secured in the shielded position each time the source is returned to that position.
2. Each sealed source storage container and source changer must have a lock or outer locked container designed to prevent unauthorized or accidental removal of the sealed source from its shielded position. Storage containers and source changers must be kept locked³ when containing sealed sources except when under the direct surveillance of a radiographer or a radiographer's assistant.
3. The control panel of each radiation machine shall be equipped with a lock that will prevent the unauthorized use of an x-ray system or the accidental production of radiation. The radiation machine shall be kept locked and the key removed at all times except when under the direct visual surveillance of a radiographer or a radiographer's assistant.

500.09 Radiation Survey Instruments.

1. The licensee or registrant shall maintain sufficient calibrated and operable radiation survey instruments at each location where sources of radiation are present to make radiation surveys required by this section and 400.17 of these regulations. Instrumentation required by this section must be capable of measuring a range from 0.02 millisieverts (2 mrem) per hour through 0.01 sievert (1 rem) per hour.
2. The licensee or registrant shall have each radiation survey instrument required under 500.09.(1) calibrated:
 - a. at energies appropriate for use and at intervals not to exceed 6 months and after each instrument servicing, except for battery changes;
 - b. for linear scale instruments at 2 points located approximately 1/3 and 2/3 of full-scale on each scale; for logarithmic scale instruments at mid-range of each decade, and at 2 points of at least 1 decade; and for digital instruments at 3 points between 0.02 and 10 millisieverts (2 and 1000 mrem) per hour; and
 - c. so that an accuracy within plus or minus 20 percent of the true radiation dose rate can be demonstrated at each point checked.

³ If a keyed lock, the key must be removed at all times.

3. The licensee or registrant shall maintain records of the results of the instrument calibrations in accordance with 500.26.
4. Each radiation survey instrument shall be checked with a radiation source at the beginning of each day of use and at the beginning of each work shift to ensure it is operating properly.

500.10 Leak Testing and Replacement of Sealed Sources.

1. The replacement of any sealed source fastened to or contained in a radiographic exposure device and leak testing, of any sealed source shall be performed only by persons specifically authorized to do so by the Agency, the U.S. Nuclear Regulatory Commission, or an Agreement State.
2. The opening, repair, or modification of any sealed source must be performed by persons specifically authorized to do so by the Agency, the U.S. Nuclear Regulatory Commission, or another Agreement State.
3. Testing and recordkeeping requirements.
 - a. Each licensee who uses a sealed source shall have the source tested for leakage at intervals not to exceed 6 months. The leak testing of the source must be performed using a method approved by the Agency, the U.S. Nuclear Regulatory Commission, or by another Agreement State. The wipe sample should be taken from the nearest accessible point to the sealed source where contamination might accumulate. The wipe sample must be analyzed for radioactive contamination. The analysis must be capable of detecting the presence of 185 becquerel (0.005 μCi) of radioactive material on the test sample and must be performed by a person specifically authorized by the Agency, the U.S. Nuclear Regulatory Commission, or another Agreement State to perform the analysis.
 - b. The licensee shall maintain records of the leak tests in accordance with 500.27.
 - c. Unless a sealed source is accompanied by a certificate from the transferor that shows that it has been leak tested within 6 months before the transfer, it may not be used by the licensee until tested for leakage. Sealed sources that are in storage and not in use do not require leak testing, but must be tested before use or transfer to another person if the interval of storage exceeds 6 months.
4. Any test conducted pursuant to 500.10(2) and (3) which reveals the presence of 185 becquerel (0.005 μCi) or more of removable radioactive material shall be considered evidence that the sealed source is leaking. The licensee shall immediately withdraw the equipment involved from use and shall have it decontaminated and repaired or disposed of in

accordance with regulations of the Agency. A report must be filed with the Agency within 5 days of any test with results that exceed the threshold in this paragraph, describing the equipment involved, the test results, and the corrective action taken.

5. Each exposure device using depleted uranium (DU) shielding and an "S" tube configuration must be tested for DU contamination at intervals not to exceed 12 months. The analysis must be capable of detecting the presence of 185 becquerel (0.005 μ Ci) of radioactive material on the test sample and must be performed by a person specifically authorized by the Agency, the U.S. Nuclear Regulatory Commission, or another Agreement State to perform the analysis. Should such testing reveal the presence of DU contamination, the exposure device must be removed from use until an evaluation of the wear of the S-tube has been made. Should the evaluation reveal that the S-tube is worn through, the device may not be used again. DU shielded devices do not have to be tested for DU contamination while not in use and in storage. Before using or transferring such a device, however, the device must be tested for DU contamination, if the interval of storage exceeds 12 months. A record of the DU leak-test must be made in accordance with 500.27.

500.11 Quarterly Inventory.

1. Each licensee or registrant shall conduct a quarterly physical inventory to account for all sources of radiation, and for devices containing depleted uranium received and possessed under the license.
2. The licensee or registrant shall maintain records of the quarterly inventory in accordance with 500.28.

500.12 Inspection and Maintenance of Radiation Machines, Radiographic Exposure Devices, Transport and Storage Containers, Associated Equipment, Source Changers, and Survey Instruments.

1. The licensee or registrant shall perform visual and operability checks on survey meters, radiation machines, radiographic exposure devices, transport and storage containers, associated equipment and source changers before each day's use, or work shift, to ensure that:
 - a. The equipment is in good working condition;
 - b. The sources are adequately shielded; and
 - c. Required labeling is present.
2. Survey instrument operability must be performed using checks sources or other appropriate means.

3. If equipment problems are found, the equipment must be removed from service until repaired.
4. Each licensee or registrant shall have written procedures for and perform inspection and routine maintenance of radiation machines, radiographic exposure devices, source changers, associated equipment, transport and storage containers, and survey instruments at intervals not to exceed 3 months or before the first use thereafter to ensure the proper functioning of components important to safety. If equipment problems are found, the equipment must be removed from service until repaired.
5. The licensee(s) inspection and maintenance program must include procedures to assure that Type B packages are shipped and maintained in accordance with the certificate of compliance or other approval.
6. Records of equipment problems and of any maintenance performed under 500.12 must be made in accordance with 500.30.

500.13 Permanent Radiographic Installations.

1. Each entrance that is used for personnel access to the high radiation area in a permanent radiographic installation must have either:
 - a. An entrance control of the type described in 400.19 of these regulations that causes the radiation level upon entry into the area to be reduced; or
 - b. Both conspicuous visible and audible warning signals to warn of the presence of radiation. The visible signal must be actuated by radiation whenever the source is exposed or the machine is energized. The audible signal must be actuated when an attempt is made to enter the installation while the source is exposed or the machine is energized.
2. The alarm system must be tested for proper operation with a radiation source each day before the installation is used for radiographic operations. The test must include a check of both the visible and audible signals. Entrance control devices that reduce the radiation level upon entry as designated in 500.13(1)(a) must be tested monthly. If an entrance control device or an alarm is operating improperly, it must be immediately labeled as defective and repaired within 7 calendar days. The facility may continue to be used during this 7-day period, provided the licensee or registrant implements the continuous surveillance requirements of 500.22 and uses an alarming ratemeter. Test records for entrance controls and audible and visual alarms must be maintained in accordance with 500.31.

500.14 Labeling, Storage, and Transportation.

1. The licensee may not use a source changer or a container to store radioactive material unless the source changer or the storage container has securely attached to it a durable, legible, and clearly visible label bearing the standard trefoil radiation caution symbol conventional colors, i.e., magenta, purple or black on a yellow background, having a minimum diameter of 25 mm, and the wording:

CAUTION *

RADIOACTIVE MATERIAL

NOTIFY CIVIL AUTHORITIES [or " NAME OF COMPANY"]

* --- or "DANGER"

2. The licensee may not transport radioactive material unless the material is packaged, and the package is labeled, marked, and accompanied with appropriate shipping papers in accordance with regulations set out in Section 1300.
3. Radiographic exposure devices, source changers, storage containers, and radiation machines, must be physically secured to prevent tampering or removal by unauthorized personnel. The licensee shall store radioactive material in a manner that will minimize danger from explosion or fire.
4. The licensee shall lock and physically secure the transport package containing radioactive material in the transporting vehicle to prevent accidental loss, tampering, or unauthorized removal.

Radiation Safety Requirements

500.15 Conducting Industrial Radiographic Operations.

1. Whenever radiography is performed at a location other than a permanent radiographic installation, the radiographer must be accompanied by at least one other qualified radiographer or an individual who has at a minimum met the requirements of 500.17(3). The additional qualified individual shall observe the operations and be capable of providing immediate assistance to prevent unauthorized entry. Radiography may not be performed if only one qualified individual is present.
2. All radiographic operations must be conducted in a permanent radiographic installation unless otherwise specifically authorized by the Agency.
3. Except when physically impossible, collimators shall be used in industrial radiographic operations that use radiographic exposure devices that allow the source to be moved out of the device.

4. A licensee or registrant may conduct lay-barge, offshore platform, or underwater radiography only if procedures have been approved by the Agency, the U.S. Nuclear Regulatory Commission, or by another Agreement State.

500.16 Radiation Safety Officer. The radiation safety officer shall ensure that radiation safety activities are being performed in accordance with approved procedures and regulatory requirements in the daily operation of the licensee's or registrant's program.

1. The minimum qualifications, training, and experience for radiation safety officers for industrial radiography are as follows:
 - a. Completion of the training and testing requirements of 500.17(1);
 - b. 2000 hours of hands-on experience as a qualified radiographer in industrial radiographic operations; and
 - c. Formal training in the establishment and maintenance of a radiation protection program.
2. The Agency will consider alternatives when the radiation safety officer has appropriate training and experience in the field of ionizing radiation, and in addition, has adequate formal training with respect to the establishment and maintenance of a radiation safety protection program.
3. The specific duties and authorities of the radiation safety officer include:
 - a. Establishing and overseeing all operating, emergency, and ALARA procedures as required by Section 400 of these regulations and reviewing them regularly to ensure that they conform to Agency regulations and to the license or registration conditions;
 - b. Overseeing and approving the training program for radiographic personnel to ensure that appropriate and effective radiation protection practices are taught;
 - c. Ensuring that required radiation surveys and leak tests are performed and documented in accordance with the regulations, including any corrective measures when levels of radiation exceed established limits;
 - d. Ensuring that personnel monitoring devices are calibrated, if applicable, and used properly; that records are kept of the monitoring results; and that timely notifications are made as required by Section D of these regulations; and

- e. Ensuring that operations are conducted safely and for implementing corrective actions including terminating operations.
- 4. Licensees and registrants will have 2 years from the effective date of these regulations to meet the requirements of 500.16(1) and 500.16(2).

500.17 Training.

- 1. The licensee or registrant may not permit any individual to act as a radiographer until the individual:
 - a. Has received at least 40 hours of training in the subjects outlined in 500.17(7), in addition to on-the-job training consisting of hands-on experience under the supervision of a radiographer and is certified through a radiographer certification program by a certifying entity in accordance with the criteria specified in Appendix A of this section. The on-the-job training shall include a minimum of 2 months (320 hours) of active participation in the performance of industrial radiography utilizing radioactive material and/or 1 month (160 hours) of active participation in the performance of industrial radiography utilizing radiation machines. Individuals performing industrial radiography utilizing radioactive materials and radiation machines must complete both segments of the on-the-job training (3 months or 480 hours); or
 - b. The licensee or registrant may, until 2 years after the effective date of these regulations, allow an individual who has not met the requirements of 500.17(1)(a), to act as a radiographer after the individual has received at least 40 hours of training in the subjects outlined in 500.17(7) and demonstrated an understanding of these subjects by successful completion of a written examination that was previously submitted to and approved by the Agency, the U.S. Nuclear Regulatory Commission, or another Agreement State, in addition to on-the-job training consisting of hands-on experience under the supervision of a radiographer. The on-the-job training shall include a minimum of 2 months (320 hours) of active participation in the performance of industrial radiography utilizing radioactive material and/or 1 month (160 hours) of active participation in the performance of industrial radiography utilizing radiation machines. Individuals performing industrial radiography utilizing radioactive materials and radiation machines must complete both segments of the on-the-job training (3 months or 480 hours).
- 2. In addition, the licensee or registrant may not permit any individual to act as a radiographer until the individual:

- a. Has received copies of and instruction in the requirements described in the regulations contained in this section, and applicable sections of Sections 400, 1000, and 1300 of these regulations, in the license or registration under which the radiographer will perform industrial radiography, and the licensee's or registrant's operating and emergency procedures;
 - b. Has demonstrated an understanding of items in 500.17(2)(a) by successful completion of a written or oral examination;
 - c. Has received training in the use of the registrant's radiation machines, or the licensee's radiographic exposure devices, sealed sources, in the daily inspection of devices and associated equipment, and in the use of radiation survey instruments; and
 - d. Has demonstrated understanding of the use of the equipment described in 500.17(2)(c) by successful completion of a practical examination.
3. The licensee or registrant may not permit any individual to act as a radiographer's assistant until the individual:
- a. Has received copies of and instruction in the requirements described in the regulations contained in this section, and applicable Sections 400, 1000, and 1300 of these regulations, in the license or registration under which the radiographer's assistant will perform industrial radiography, and the licensee's or registrant's operating and emergency procedures;
 - b. Has demonstrated an understanding of items in 500.17(3)(a) by successful completion of a written or oral examination;
 - c. Under the personal supervision of a radiographer, has received training in the use of the registrant's radiation machines, or the licensee's radiographic exposure devices and sealed sources, in the daily inspection of devices and associated equipment, and in the use of radiation survey instruments; and
 - d. Has demonstrated understanding of the use of the equipment described in 500.17(3)(c) by successful completion of a practical examination.
4. The licensee or registrant shall provide annual refresher safety training for each radiographer and radiographer's assistant at intervals not to exceed 12 months.
5. Except as provided in 500.17.5(d), the radiation safety officer or designee shall conduct an inspection program of the job performance of each

radiographer and radiographer's assistant to ensure that the Agency's regulations, license or registration requirements, and operating and emergency procedures are followed. The inspection program must:

- a. Include observation of the performance of each radiographer and radiographer's assistant during an actual industrial radiographic operation, at intervals not to exceed 6 months; and
 - b. Provide that, if a radiographer or a radiographer's assistant has not participated in an industrial radiographic operation for more than 6 months since the last inspection, the radiographer must demonstrate knowledge of the training requirements of 500.17(2)(c) and the radiographer's assistant must demonstrate knowledge of the training requirements of 500.17(3)(c) by a practical examination before these individuals can next participate in a radiographic operation.
 - c. The Agency may consider alternatives in those situations where the individual serves as both radiographer and radiation safety officer.
 - d. In those operations where a single individual serves as both radiographer and radiation safety officer, and performs all radiography operations, an inspection program is not required.
6. The licensee or registrant shall maintain records of the above training to include certification documents, written, oral and practical examinations, refresher safety training and inspections of job performance in accordance with 500.32.
 7. The licensee or registrant shall include the following subjects required in 500.17(1):
 - a. Fundamentals of radiation safety including:
 - i. Characteristics of gamma and x-radiation;
 - ii. Units of radiation dose and quantity of radioactivity;
 - iii. Hazards of exposure to radiation;
 - iv. Levels of radiation from sources of radiation; and
 - v. Methods of controlling radiation dose (time, distance, and shielding);
 - b. Radiation detection instruments including:
 - i. Use, operation, calibration, and limitations of radiation survey instruments;

- ii. Survey techniques; and
 - iii. Use of personnel monitoring equipment;
 - c. Equipment to be used including:
 - i. Operation and control of radiographic exposure equipment, remote handling equipment, and storage containers, including pictures or models of source assemblies (pigtailed);
 - ii. Operation and control of radiation machines;
 - iii. Storage, control, and disposal of sources of radiation; and
 - iv. Inspection and maintenance of equipment.
 - d. The requirements of pertinent state and federal regulations; and
 - e. Case histories of accidents in radiography.
8. Licensees and registrants will have one year from the effective date of these regulations to comply with the additional training requirements specified in 500.17(2)(a) and 500.17(3)(a).

500.18 Operating and Emergency Procedures.

- 1. Operating and emergency procedures must include, as a minimum, instructions in at least the following:
 - a. Appropriate handling and use of sources of radiation so that no person is likely to be exposed to radiation doses in excess of the limits established in Section 400 of these regulations;
 - b. methods and occasions for conducting radiation surveys;
 - c. methods for posting and controlling access to radiographic areas;
 - d. methods and occasions for locking and securing sources of radiation;
 - e. personnel monitoring and the use of personnel monitoring equipment;
 - f. transporting equipment to field locations, including packing of radiographic exposure devices and storage containers in the vehicles, placarding of vehicles when required, and control of equipment during transportation as described in Section 1300 of these regulations;

- g. the inspection, maintenance, and operability checks of radiographic exposure devices, radiation machines, survey instruments, alarming ratemeters, transport containers, and storage containers;
 - h. Steps that must be taken immediately by radiography personnel in the event a pocket dosimeter is found to be off-scale or an alarming ratemeter alarms unexpectedly;
 - i. The procedure(s) for identifying and reporting defects and noncompliance, as required by 500.38;
 - j. The procedure for notifying proper persons in the event of an accident or incident;
 - k. Minimizing exposure of persons in the event of an accident or incident, including a source disconnect, a transport accident, or loss of a source of radiation;
 - l. Source recovery procedure if licensee will perform source recoveries; and
 - m. Maintenance of records.
2. The licensee or registrant shall maintain copies of current operating and emergency procedures in accordance with 500.33 and 500.37.

500.19 Supervision of Radiographer's Assistants. The radiographer's assistant shall be under the personal supervision of a radiographer when using radiation machines, radiographic exposure devices, associated equipment, or a sealed source, or while conducting radiation surveys required by 500.21(2) to determine that the sealed source has returned to the shielded position or the radiation machine is off after an exposure. The personal supervision must include:

- 1. The radiographer's physical presence at the site where the sources of radiation are being used;
- 2. The availability of the radiographer to give immediate assistance if required; and
- 3. The radiographer's direct observation of the assistant's performance of the operations referred to in this section.

500.20 Personnel Monitoring.

- 1. The licensee or registrant shall not permit any individual to act as a radiographer or a radiographer's assistant unless, at all times during radiographic operations, each individual wears, on the trunk of the body, a direct reading pocket dosimeter, an alarming ratemeter, and a personnel

dosimeter that is processed and evaluated by an accredited National Voluntary Laboratory Accreditation Program (NVLAP) processor. At permanent radiographic installations where other appropriate alarming or warning devices are in routine use, the use of an alarming ratemeter is not required.

- a. Pocket dosimeters must have a range from zero to 2 millisieverts (200 mrem) and must be recharged at the start of each shift. Electronic personal dosimeters may only be used in place of ion-chamber pocket dosimeters.
 - b. Each personnel dosimeter must be assigned to and worn by only one individual.
 - c. Personnel dosimeters must be exchanged at periods not to exceed one month.
 - d. After replacement, each personnel dosimeter must be returned to the supplier for processing within 14 calendar days of the end of the monitoring period, or as soon as practicable. In circumstances that make it impossible to return each personnel dosimeter in 14 calendar days, such circumstances must be documented and available for review by the Agency.
2. Direct reading dosimeters such as pocket dosimeters or electronic personal dosimeters, must be read and the exposures recorded at the beginning and end of each shift, and records must be maintained in accordance with 500.34.
 3. Pocket dosimeters or electronic personal dosimeters must be checked at periods not to exceed 12 months for correct response to radiation, and records must be maintained in accordance with 500.34. Acceptable dosimeters shall read within plus or minus 20 percent of the true radiation exposure.
 4. If an individual's pocket dosimeter is found to be offscale beyond its range, or the electronic personal dosimeter reads greater than 2 millisieverts (200 mrem), the individual's personnel dosimeter must be sent for processing within 24 hours. In addition, the individual may not resume work associated with the use of sources of radiation until a determination of the individual's radiation exposure has been made. This determination must be made by the radiation safety officer or the radiation safety officer's designee. The results of this determination must be included in the records maintained in accordance with 500.34.
 5. If a personnel dosimeter is lost or damaged, the worker shall cease work immediately until a replacement personnel dosimeter is provided and the exposure is calculated for the time period from issuance to loss or damage

of the personnel dosimeter. The results of the calculated exposure and the time period for which the personnel dosimeter was lost or damaged must be included in the records maintained in accordance with 500.34.

6. Dosimetry Reports received from the accredited (NVLAP) personnel dosimeter processor must be retained in accordance with 500.34.
7. Each alarming ratemeter must:
 - a. be checked to ensure that the alarm functions properly (sounds) before using at the start of each shift;
 - b. be set to give an alarm signal at a preset dose rate of 5 millisieverts (500 mrem) per hour; with an accuracy of plus or minus 20 percent of the true radiation dose rate;
 - c. require special means to change the preset alarm function; and
 - d. be calibrated at periods not to exceed 12 months for correct response to radiation. The licensee or registrant shall maintain records of alarming ratemeter calibrations in accordance with 500.34.

500.21 Radiation Surveys. The licensee or registrant shall:

1. Conduct all surveys with a calibrated and operable radiation survey instrument that meets the requirements of 500.09;
2. Conduct a survey of the entire circumference of the radiographic exposure device and the entire length of the guide tube after each exposure when approaching the device or the guide tube. The survey must determine that the sealed source has returned to its shielded position before exchanging films, repositioning the exposure head, or dismantling equipment. Radiation machines shall be surveyed after each exposure to determine that the machine is off;
3. Conduct a survey of the radiographic exposure device whenever the source is exchanged and whenever a radiographic exposure device is placed in a storage area as defined in 500.03, to ensure that the sealed source is in its shielded position; and
4. An area survey of the perimeter of the restricted area with a calibrated and operable radiation survey instrument shall be made with the source exposed before or during each radiographic exposure. Except for the initial radiographic exposure on each shift, the survey may be omitted when the source-target configuration for an exposure is substantially the same as that of the preceding exposure or if the exposure is made in a permanent radiographic facility.

5. Maintain records in accordance with 500.35.

500.22 Surveillance. During each radiographic operation, the radiographer or radiographer's assistant shall ensure continuous direct visual surveillance of the operation to protect against unauthorized entry into a radiation area or a high radiation area, as defined in Section 100 of these regulations, except at permanent radiographic installations where all entryways are locked and the requirements of 500.13 are met.

500.23 Posting. All areas in which industrial radiography is being performed shall be conspicuously posted as required by 400.30(1) and (2) of these regulations. The exceptions listed in 400.31 of these regulations do not apply to industrial radiographic operations.

Recordkeeping Requirements

500.24 Records for Industrial Radiography. Each licensee or registrant shall maintain a copy of its license or registration, documents incorporated by reference, and amendments to each of these items until superseded by new documents approved by the Agency, or until the Agency terminates the license or registration.

500.25 Records of Receipt and Transfer of Sources of Radiation.

1. Each licensee or registrant shall maintain records showing the receipts and transfers of sealed sources, devices using DU for shielding, and radiation machines, and retain each record for 3 years after it is made.
2. These records must include the date, the name of the individual making the record, radionuclide, number of becquerels (curies) or mass (for DU), and manufacturer, model, and serial number of each source of radiation and/or device, as appropriate.

500.26 Records of Radiation Survey Instruments. Each licensee or registrant shall maintain records of the calibrations of its radiation survey instruments that are required under 100.09 and retain each record for 3 years after it is made.

500.27 Records of Leak Testing of Sealed Sources and Devices Containing DU. Each licensee shall maintain records of leak test results for sealed sources and for devices containing DU. The results must be stated in units of becquerels (μCi). The licensee shall retain each record for 3 years after it is made or until the source in storage is removed.

500.28 Records of Quarterly Inventory.

1. Each licensee or registrant shall maintain records of the quarterly inventory of sources of radiation, including devices containing depleted uranium as required by 500.11, and retain each record for 3 years.

2. The record must include the date of the inventory, name of the individual conducting the inventory, radionuclide, number of becquerels (curies) or mass (for DU) in each device, location of sources of radiation and/or devices, and manufacturer, model, and serial number of each source of radiation and/or device, as appropriate.

500.29 Utilization Logs.

1. Each licensee or registrant shall maintain utilization logs showing for each source of radiation the following information:
 - a. a description, including the make, model, and serial number of the radiation machine, or the radiographic exposure device, transport, or storage container in which a sealed source is located;
 - b. the identity and signature of the radiographer to whom assigned;
 - c. the locations and dates of use including the dates removed and returned to storage; and
 - d. For permanent radiographic installations, the dates each radiation machine is energized.
2. The licensee or registrant shall retain the logs required by 500.29.1 for 3 years.

500.30 Records of Inspection and Maintenance of Radiation Machines, Radiographic Exposure Devices, Transport and Storage Containers, Associated Equipment, Source Changers, and Survey Instruments.

1. Each licensee or registrant shall maintain records specified in 100.12 of equipment problems found in daily checks and quarterly inspections of radiation machines, radiographic exposure devices, transport and storage containers, associated equipment, source changers and survey instruments; and retain each record for 3 years after it is made.
2. The record must include the date of check or inspection, name of inspector, equipment involved, any problems found, and what repair and/or maintenance, if any, was performed.

500.31 Records of Alarm System and Entrance Control Checks at Permanent Radiographic Installations. Each licensee or registrant shall maintain records of alarm system and entrance control device tests required by 500.13 and retain each record for 3 years after it is made.

500.32 Records of Training and Certification. Each licensee or registrant shall maintain the following records for 3 years:

1. Records of training of each radiographer and each radiographer's assistant. The record must include radiographer certification documents and verification of certification status, copies of written tests, dates of oral and practical examinations, the names of individuals conducting and receiving the oral and practical examinations, and a list of items tested and the results of the oral and practical examinations; and
2. Records of annual refresher safety training and semi-annual inspections of job performance for each radiographer and each radiographer's assistant. The records must list the topics discussed during the refresher safety training, the dates the annual refresher safety training was conducted, and names of the instructors and attendees. For inspections of job performance, the records must also include a list showing the items checked and any non-compliance observed by the radiation safety officer or designee.

500.33 Copies of Operating and Emergency Procedures. Each licensee or registrant shall maintain a copy of current operating and emergency procedures until the Agency terminates the license or registration. Superseded material must be retained for 3 years after the change is made.

500.34 Records of Personnel Monitoring. Each licensee or registrant shall maintain the following exposure records specified in 500.20:

1. Direct reading dosimeter readings and yearly operability checks required by 500.20.1 and 500.20(3) for 3 years after the record is made.
2. Records of alarming ratemeter calibrations for 3 years after each record is made.
3. Reports received from the accredited (NVLAP) personnel dosimeter processor until the Agency terminates the license or registration; and
4. Records of estimates of exposures as a result of off-scale personal direct reading dosimeters, or lost or damaged personnel dosimeters, until the Agency terminates the license or registration.

500.35 Records of Radiation Surveys. Each licensee shall maintain a record of each exposure device survey conducted before the device is placed in storage as specified in 500.21(3). Each record must be maintained for 3 years after it is made.

500.36 Form of Records. Each record required by the section must be legible throughout the specified retention period. The record may be the original or a reproduced copy or a microform provided that the copy or microform is authenticated by authorized personnel and that the microform is capable of reproducing a clear copy throughout the required retention period. The record may also be stored in electronic media with the capability for producing legible,

accurate, and complete records during the required retention period. Records, such as letters, drawings, and specifications, must include all pertinent information, such as stamps, initials, and signatures. The licensee or registrant shall maintain adequate safeguards against tampering with and loss of records.

500.37 Location of Documents and Records.

1. Each licensee or registrant shall maintain copies of records required by this section and other applicable sections of these regulations at the location specified in 500.05(11).
2. Each licensee or registrant shall also maintain current copies of the following documents and records sufficient to demonstrate compliance at each applicable field station and each temporary jobsite;
 - a. The license or registration authorizing the use of sources of radiation;
 - b. A copy of Sections 100, 400, 500 & 1000 of these regulations;
 - c. Utilization logs for each source of radiation dispatched from that location as required by 500.29;
 - d. Records of equipment problems identified in daily checks of equipment as required by 500.30(1);
 - e. Records of alarm system and entrance control checks required by 500.31, if applicable;
 - f. Records of dosimeter readings as required by 500.34;
 - g. Operating and emergency procedures as required by 500.33;
 - h. Evidence of the latest calibration of the radiation survey instruments in use at the site, as required by 500.26;
 - i. Evidence of the latest calibrations of alarming ratemeters and operability checks of dosimeters as required by 500.34;
 - j. Survey records as required by 500.35 and 400.43 of these regulations as applicable, for the period of operation at the site;
 - k. The shipping papers for the transportation of radioactive materials required by Section 300 of these regulations; and
 - l. When operating under reciprocity pursuant to Section 300 of these regulations, a copy of the applicable State license or registration, or U.S. Nuclear Regulatory Commission license authorizing the use of sources of radiation.

Notifications

500.38 Notifications.

1. In addition to the reporting requirements specified in 100.07 and under other sections of these regulations, each licensee or registrant shall provide a written report to the Agency within 30 days of the occurrence of any of the following incidents involving radiographic equipment:
 - a. Unintentional disconnection of the source assembly from the control cable.
 - b. Inability to retract the source assembly to its fully shielded position and secure it in this position.
 - c. Failure of any component (critical to safe operation of the device) to properly perform its intended function.
 - d. An indicator on a radiation-producing machine fails to show that radiation is being produced, an exposure switch fails to terminate production of radiation when turned to the off position, or a safety interlock fails to terminate x-ray production.
2. The licensee or registrant shall include the following information in each report submitted in accordance with 500.38(1) and in each report of overexposure submitted under Section 400.54 of these regulations which involves failure of safety components of radiography equipment:
 - a. A description of the equipment problem.
 - b. Cause of each incident, if known.
 - c. Manufacturer and model number of equipment involved in the incident.
 - d. Place, time and date of the incident.
 - e. Actions taken to establish normal operations.
 - f. Corrective actions taken or planned to prevent recurrence.
 - g. Names and qualifications of personnel involved in the incident.
3. Any licensee or registrant conducting radiographic operations or storing sources of radiation at any location not listed on the license or registration for a period in excess of 180 days in a calendar year, shall notify the Agency prior to exceeding the 180 days.

500.39 Specific Requirements for Radiographic Personnel Performing Industrial Radiography.

1. At a job site, the following shall be supplied by the licensee or registrant:
 - a. At least one operable, calibrated survey instrument for each exposure device or radiation machine in use;
 - b. A current personnel dosimeter that is processed and evaluated by an accredited (NVLAP) processor for each person performing radiographic operations;
 - c. An operable, calibrated pocket dosimeter with a range of zero to 200 milliroentgens for each person performing radiographic operations ;
 - d. An operable, calibrated, alarming ratemeter for each person performing radiographic operations; and
 - e. The appropriate barrier ropes and signs.
2. Each radiographer at a job site shall have on their person a valid certification ID card issued by a certifying entity.
3. Industrial radiographic operations shall not be performed if any of the items in 500.39(1) and 500.39(2) are not available at the job site or are inoperable.
4. During an inspection, the Agency may terminate an operation if any of the items in 500.39(1) and 500.39(2) are not available or operable, or if the required number of radiographic personnel are not present. Operations shall not be resumed until all required conditions are met.

Subpart 78**Section 500****APPENDIX A****Radiographer Certification****I. Requirements for an Independent Certifying Organization.**

An independent certifying organization shall:

- A. Be an organization such as a society or association, whose members participate in, or have an interest in, the field of industrial radiography;
- B. Make its membership available to the general public nationwide. Membership shall not be restricted because of race, color, religion, sex, age, national origin or disability;
- C. Have a certification program open to nonmembers, as well as members;
- D. Be an incorporated, nationally recognized organization, that is involved in setting national standards of practice within its fields of expertise;
- E. Have an adequate staff, a viable system for financing its operations, and a policy and decision-making review board;
- F. Have a set of written organizational by-laws and policies that provide adequate assurance of lack of conflict of interest and a system for monitoring and enforcing those by-laws and policies;
- G. Have a committee, whose members can carry out their responsibilities impartially, to review and approve the certification guidelines and procedures, and to advise the organization's staff in implementing the certification program;
- H. Have a committee, whose members can carry out their responsibilities impartially, to review complaints against certified individuals and to determine appropriate sanctions;
- I. Have written procedures describing all aspects of its certification program, maintain records of the current status of each individual's certification and the administration of its certification program;
- J. Have procedures to ensure that certified individuals are provided due process with respect to the administration of its certification program, including the process of becoming certified and any sanctions imposed against certified individuals;
- K. Have procedures for proctoring examinations, including qualifications for proctors. These procedures must ensure that the individuals proctoring each examination are not employed by the same company or corporation (or a wholly-owned subsidiary of such company or corporation) as any of the examinees;

- L. Exchange information about certified individuals with the U.S. Nuclear Regulatory Commission and other independent certifying organizations and/or Agreement States and allow periodic review of its certification program and related records; and
- M. Provide a description to the U.S. Nuclear Regulatory Commission of its procedures for choosing examination sites and for providing an appropriate examination environment.

II. Requirements for Certification Programs.

All certification programs must:

- A. Requires applicants for certifications to receive training in the topics set forth in 500.17(7) or equivalent Agreement State or U.S. Nuclear Regulatory Commission regulations, and satisfactorily complete a written examination covering these topics;
- B. Require applicants for certification to provide documentation that demonstrates that the applicant has:
 - (1) Received training in the topics set forth in 500.17(7) or equivalent Agreement State or U.S. Nuclear Regulatory Commission regulations;
 - (2) Satisfactorily completed a minimum period of on-the-job training as specified in 500.17(1); and
 - (3) Received verification by a State licensee or registrant or a U.S. Nuclear Regulatory Commission licensee that the applicant has demonstrated the capability of independently working as a radiographer.
- C. Include procedures to ensure that all examination questions are protected from disclosure;
- D. Include procedures for denying an application and revoking, suspending, and reinstating a certification;
- E. Provide a certification period of not less than 3 years nor more than 5 years;
- F. Include procedures for renewing certifications and, if the procedures allow renewals without examination, require evidence of recent full-time employment and annual refresher training; and
- G. Provide a timely response to inquiries, by telephone or letter, from members of the public, about an individual's certification status.

III. Requirements for Written Examinations

All examinations must be:

- A. Designed to test an individual's knowledge and understanding of the topics listed in 500.17(7) or equivalent Agreement State or U.S. Nuclear Regulatory Commission requirements;

- B. Written in a multiple-choice format; and
- C. Have test items drawn from a question bank containing psychometrically valid questions based on the material in 500.17(7).

e.g., guide tube, control tube, control (drive) cable, removable source stop,

“J” tube and collimator when used as an exposure head.

An exposure head is also known as a source stop.

If a keyed lock, the key must be removed at all times.